GABLE-TOP PACKAGE FOR POURABLE FOOD PRODUCTS AND METHOD FOR DIMENSIONING THEREOF

TECHNICAL FIELD

The present invention relates to a gable-top package for pourable food products.

BACKGROUND ART

As is known, many pourable food products, such as fruit juice, UHT (ultra-high-temperature processed) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

The packaging material has a multilayer structure comprising a layer of fibrous material, e.g. paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene; in the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of oxygen-barrier material defined, for example, by an aluminium film, which is superimposed on a layer of heat-seal plastic material and is in turn covered with another layer of heat-seal plastic material eventually defining the inner face of the package contacting the food product.

Typical examples of such packages are the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark) and the so-called "gable-top" package commonly known by the trade name Tetra Rex (registered trademark), which has a gabled top portion defined by two inclined or sloping walls joined together at a top transversal seal.

The above packages may be formed from a continuous tube obtained by bending and longitudinally sealing a web packaging material; the web of packaging material is sterilized on the packaging machine itself, e.g. by applying a chemical sterilizing agent, such as a hydrogen peroxide solution, which, after sterilization, is

removed, e.g. vaporized by heating, from the surfaces of the packaging material. The web of packaging material so sterilized is maintained in a closed sterile environment, and is folded and sealed longitudinally to form a vertical tube.

The tube is filled with the sterilized or sterile-processed food product, and is sealed and cut at equally spaced cross sections to form pillow packs, which are then folded mechanically to form the finished packages.

Two basic types of web-fed filling and forming machines are known: a first and more common type is a machine having two pairs of reciprocating jaws; this type of machines includes, e.g the TB/21, TBA/19 and TBA/21 series machines, and Tetra Pak A3 packaging machines, produced by Tetra Pak Carton Ambient AB at LUND (Sweden), Ruben Rausings gata and by Tetra Pak Carton Ambient S.p.A. at Modena (Italy), Via Delfini 1. The second type of web-fed packaging machine is the endless chain type, wherein forming and sealing units are carried by two facing endless chains rather then by reciprocating jaws. One example of this kind of machine is the TBA/22 packaging machine, also produced by Tetra Pak Carton Ambient S.p.A.

To allow folding of the web packaging material both during forming and final folding, crease lines defining a so-called “crease pattern” are formed on the packaging material at the production line.

Alternatively, the packaging material may be cut into blanks, which are formed into packages on forming mandrel, and the resulting packages are filled with the food product and sealed.

In particular, once formed on the forming mandrels, the unfinished packages have an upwardly opened parallelepiped shape; the gabled top portion is obtained by compressing opposite side walls of the upper portion of the unfinished packages towards each other in order to draw up the upper edges of the other walls, which are then sealed together to form the transversal seal.

Once formed, packages of the above type may undergo further processing

steps, such as the application of a re-closable opening device.

Gable-top packages are very conveniently used in combination with re-closable opening devices because the sloping top walls are wider than corresponding flat portions of parallelepiped and therefore allow the application of larger opening devices, e.g. provided with screw caps or the like.

Within the packaging industry, a need is felt for continuous improvements, particularly as to the possibility to differentiate shape and sizes of gable top packages while ensuring properly folding of the packaging material. This need derives from market requirements as to variations of the aesthetic appearance of the packages and from the necessity to ensure, for any type of food product, a pouring without the phenomenon commonly known as gulping, i.e. the discontinuous output flow of the product from the package characterized by alternate phases of obstructed flow and conspicuous gushing out with possible splashing of the product.

As to the latter point, it should be noted that different food products may have different viscosities and therefore require different heights of the gabled top portion for ensuring proper pouring.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a gable-top type package, which allows to satisfy the above-mentioned need in a very simple and cheap way.

This object is achieved by a gable-top package as claimed in claim 1.

Another object of the present invention is to devise a method for dimensioning gable-top packages of different shapes while ensuring a properly folding of the packaging material.

This object is achieved by a method as claimed in claim 5.

BRIEF DESCRIPTION OF THE DRAWINGS

Two preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a gable-top package according to the present invention;

Figure 2 is a larger-scale perspective view of an upper portion of the package of Figure 1;

Figures 3 and 4 are different perspective views of a pillow-pack constituting an intermediate product for the production of the package of Figure 1;

Figure 5 is a larger-scale perspective view of an upper portion of the pillow-pack of Figures 3 and 4 during folding;

Figure 6 is a sheet packaging material provided with a crease pattern for the production of the package of Figure 1;

Figure 7 is a larger-scale view of a portion of the sheet packaging material of Figure 6; and

Figure 8 is a perspective view of another embodiment of a gable-top package in accordance with the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Figure 1, number 1 references a gable-top package for food products according to the present invention.

Package 1 is made from a sheet packaging material 2 (Figure 6) – hereinafter "material 2" - and essentially comprises a parallelepiped-shaped main portion 3 and a gabled top portion 4 upwardly delimiting main portion 3.

In particular, material 2 defines the exact length of packaging material which is used to produce a single package 1 and has a multilayer structure of the type previously described.

Main portion 3 has a preferably square-shaped base wall 5, a front wall 6, a back wall 7, and a pair of side walls 8, 9.

Gabled top portion 4 includes a front sloping top wall 10 provided with an opening device 24 (Figure 1), and a back sloping top wall 11 joining front sloping top wall 10 at a top transversal seal 12 of the package 1.

Gabled top portion 4 further includes a pair of top lateral flaps 13, 14 adjacent to respective lateral end portions 12a, 12b of top transversal seal 12 and folded out of the package top volume available for the food product to define respective triangular side top walls 18, 19 extending along the prolongation of respective side walls 8, 9.

Each lateral flap 13, 14 has one side defined by a relative lateral edge 15 of front sloping top wall 10 and another side formed by a relative lateral end portion 12a, 12b of top transversal seal 12 and folded onto a relative lateral edge 16 of back sloping top wall 11.

Lateral flaps 13, 14 are folded onto respective triangular top portions 20 of side walls 8, 9; top portions 20 are flat, and substantially coplanar or gently inwardly sloped with respect to respective side walls 8, 9 as better explained hereafter.

For a better comprehension of the package shape, reference is now made to Figures 3 to 7.

Package 1 can be made from a continuous tube (not shown) of packaging material, which is obtained by bending and longitudinally sealing a web packaging material, defined by repeated lengths of material 2 (Figure 6). More precisely, an edge portion 21 of material 2 is superimposed and sealed onto an opposite edge portion 22 so as to obtain a longitudinal seal 23 which extends substantially along a vertical centreline of back wall 7 of the finished package 1.

The tube is then transversally sealed at regular intervals to form transversal seals and then cut along such transversal seals to form so-called pillow packs (not shown), which are adapted to be transformed into finished packages 1 by means of a plurality of final folding steps.

As is known, a pillow pack has a parallelepiped basic portion and opposite tapered end portions tapering from basic portion to respective transversal seals.

Figures 3, 4 and 5 show an intermediate pack, referenced 26, which is obtained from a pillow pack by flattening one of the tapered end portions.

In particular, intermediate pack 26 comprises a basic parallelepiped portion

28 delimited by a base wall and four side walls respectively corresponding to walls 5, 6, 7, 8, 9 of main portion 3 of finished package 1, and an upper tapered end portion 29 designed to define gabled top portion 4 of finished package 1 and tapering from basic portion 28 to top transversal seal 12.

More specifically, upper tapered end portion 29 defines front and back sloping top walls 10, 11 of finished package 1 and is provided with lateral flaps 13, 14 protruding from opposite sides of front and back sloping top walls 10, 11 and, as above explained, adapted to be folded onto respective top portions 20 of side walls 8, 9.

Alternatively, intermediate pack 26 can be made from blanks of packaging material, each corresponding to a length of material 2; the blanks are formed into packs on forming mandrels (not shown) and the resulting packs are filled with the food product and sealed.

Material 2 (Figure 6) includes a crease pattern 30, i.e. a plurality of weakened lines obtained by creasing rolls and forming folding lines along which the material is folded during the forming and final folding steps.

Crease pattern 30 includes, in a known manner, four transversal crease lines 31, 32, 33, 34; lines 31, 32 are near the transversal ends of material 2 and delimit respective top and bottom transversal sealing areas 31a, 32a; lines 33, 34 form the horizontal corners of gabled top portion 4 and of base wall 5, and are also indicated in Figures 1, 3, 4 and 5, for the sake of clarity.

Crease pattern 30 also includes, in a known manner, four longitudinal crease lines 35, 36, 37, 38 forming the side corners of package 1 and extending between transversal crease lines 33 and 34, as well as a plurality of crease lines 40 in the area comprised between line 34 and the bottom transversal sealing area 32a, which are designed so as to produce bottom lateral flaps (known and not shown) of intermediate pack 26, adapted to be folded and flattened to obtain base wall 5. Lines 40 have a known arrangement and are not described in detail.

Longitudinal crease lines 35, 36 are near respective lateral edge portions 21, 22, whilst longitudinal crease lines 37, 38 are interposed between lines 35 and 36.

For the sake of clarity, front wall 6 of package 1 is delimited by lines 37 and 38, back wall 7 is delimited by lines 35 and 36, side wall 8 is delimited by lines 35 and 37 and side wall 9 is delimited by lines 36 and 38.

Crease pattern 30 (Figures 5 and 6) further includes a plurality of additional crease lines in the area comprised between transversal crease lines 31 and 33. Such additional crease lines include four substantially longitudinal crease lines 42, 43, 44, 45 defining the lateral corners of front sloping top wall 10 and back sloping top wall 11 and originating at intersection points 35a, 36a, 37a, 38a of line 33 with each of longitudinal lines 35, 36, 37, 38. In the shown examples, lines 42, 43, 44 and 45 are slightly inclined so as to form walls 10, 11 of trapezoidal shape tapering upwards, but could be perfectly longitudinal, i.e. constitute prolongations of longitudinal lines 35, 36, 37, 38.

Lines 42, 44, the portion of top transversal sealing area 31a comprised between lines 42 and 44, and the portion of line 33 comprised between intersection points 35a and 37a delimit a flap zone 46 defining lateral flap 13 and top portion 20 of side wall 8. Analogously, lines 43, 45, the portion of top transversal sealing area 31a comprised between lines 43 and 45, and the portion of line 33 comprised between intersection points 36a and 38a delimit a flap zone 47 defining lateral flap 14 and top portion of side wall 9. Furthermore, longitudinal crease lines 42, 43, 44, 45, transversal crease line 33 and top transversal sealing area 31a delimit other two zones 48, 49 each interposed between zones 46, 47 and defining respectively front and back sloping top walls 10, 11.

Crease pattern 37 further includes, in each flap zone 46, 47, a couple of inclined crease lines 50, 51 and, respectively 52, 53, starting from points 35a, 37a, and respectively 36a, 38a, and joined at point 31b, and respectively 31c, along crease line 31 to define an isosceles triangle with the portion of line 33 comprised between

points 35a, 37a, and respectively 36a, 38a.

Lines 50, 51, and respectively lines 52, 53, define the lateral external limits of lateral flaps 13, 14.

Three further crease lines, indicated with 54, 55, 56 for flap zone 46 and respectively with 57, 58, 59 for flap zone 47, extend from points 35a, 37a, 31b, and respectively from points 36a, 38a, 31c, to an intermediate point located inside the relative isosceles triangle and indicated with 60 for flap zone 46, and respectively with 61 for flap zone 47.

Crease lines 54, 55, and respectively crease lines 57, 58, extend symmetrically with respect to a relative prolongation of crease line 56, and respectively of crease line 59.

Lines 54, 55 of flap zone 46 extend between intermediate point 60 and respective points 35a, 37a and upwardly delimit top portion 20 of side wall 8. Analogously, lines 57, 58 of flap zone 47 extend between intermediate point 61 and respective points 36a, 38a and upwardly delimit top portion 20 of side wall 9.

Crease pattern 37 further includes, in each flap zone 46, 47, a continuous broken crease line 65, 66, i.e. a broken line without interruption, intersecting relative crease line 50, 52 and extending between relative intermediate point 60, 61 and the relative intersecting point of transversal crease line 31 with longitudinal crease line 42, 43. In particular, each continuous broken crease line 65, 66 is divided by relative crease line 50, 52 into two portions 67, 68 forming therebetween angles close to, but different from, 180°. Portions 67, 68 extend from relative crease line 50, 52 to transversal crease line 31a and to relative intermediate point 60, 61, respectively.

The above mentioned crease lines in each flap zone 46, 47 delimit a number of triangular-shaped panels A, B, C, D, E, F, G adapted to be folded according to a predefined sequence described hereafter.

In particular, referring to flap zone 46, panel A is delimited by crease lines 31, 44 and 51; panel B is delimited by crease lines 51, 55 and 56; panel C is

delimited by crease lines 33, 54 and 55 and defines top portion 20 of side wall 8; panel D is delimited by crease line 56, portion 68 of crease line 65 and the portion of crease line 50 comprised between crease lines 65 and 31; panel E is delimited by crease line 54, portion 68 of crease line 65 and the portion of crease line 50 comprised between crease lines 65 and point 35a; panel F is delimited by crease line 31, portion 67 of crease line 65 and the portion of crease line 50 comprised between crease lines 65 and crease line 31; and panel G is delimited by crease line 42, portion 67 of crease line 65 and the portion of crease line 50 comprised between crease lines 65 and point 35a.

The same definition of panels A, B, C, D, E, F, G can be applied to flap zone 47 in a completely analogous manner and will not be repeated since flap zones 46 and 47 are symmetric with respect an axis extending between, and parallel to, longitudinal crease lines 37, 38.

During the forming of each flap zone 46, 47, panels E and B are folded onto panel C so as panel F is superimposed onto panel G and panel A covers all the remaining portion of the flap zone 46, 47 to define relative side top wall 18, 19.

According to an important aspect of the present invention, crease pattern 30 in each flap zone 46, 47 of material 2 is designed so as the forming of the side top walls 18, 19 is performed by means of rotations of relative panels A, B, C, D, E, F, G as rigid bodies about their respective crease lines (50, 51, 54, 55, 56, 65 for flap zone 46 and 52, 53, 57, 58, 59, 66 for flap zone 47).

It is specified that, in the present description and in the claims, the expression "rotation of panels as rigid bodies" does not exclude little deformations of the packaging material due to the thickness thereof, in particular occurring during the overlapping of the panels.

More specifically, crease pattern 30 in each flap zone 46, 47 of material 2 is obtained by:

- choosing the value of a top angle α formed, along each side top wall 18, 19

of package 1, between opposite edges thereof converging to top transversal seal 12;

- choosing the length l of front sloping top wall 10, measured in a direction crosswise to top transversal seal 12; and

- determining position and extension of each crease line 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 65, 66 in each flap zone 46, 47 so as the forming of each side top wall 18, 19 is performed by rotations of relative panels A, B, C, D, E, F, G as rigid bodies about their respective said crease lines.

Due to the fact that each side top wall 18, 19 is defined by panel A of relative flap zone 46, 47, angle α is therefore also formed by each crease line 44, 45 with the respective portion of crease line 31 located inside respective flap zone 46, 47.

The applicant has found that the above mentioned steps allow to define different crease patterns in flap zones 46, 47, with consequent different shapes of gabled top portion 4, by using simple geometrical formulas, as explained hereafter.

For the sake of simplicity, the part of description which follows will refer to flap zone 47 only as well as to Figures 2 and 7, the same considerations applying equally well to flap zone 46 and not being repeated.

In particular, position and extension of crease lines 52, 53 can be obtained by determining angle β, formed by such lines 52, 53 with the portion of crease line 33 comprised between points 36a and 38a.

Angle β can be calculated as a function of length l by means of the following formula:

$$\beta = \operatorname{arctg}\left(\frac{l}{c/2}\right)$$

wherein c references the width of package 1, which is a given data and corresponds to the distance between crease lines 36 and 38 or 35 and 37.

Angle β allows construction of crease lines 52, 53 which start from respective points 36a, 38a and define the equal sides of an isosceles triangle, whose third side is

represented by the portion of crease line 33 comprised between points 36a and 38a.

Position and extension of crease lines 57, 58, 59 and position of intermediate point 61 can be obtained by determining angle β_2 formed by lines 57, 58 with respective crease lines 52, 53.

Angle β_2 can be calculated by means of the following formula:

$$\beta_2 = \frac{\beta - (\theta_1 - \theta)}{2}$$

wherein θ references the angle formed between each crease line 43, 45 and respective crease line 52, 53, whilst θ_1 references the angle formed by each crease line 43, 45 with the portion of crease line 33 comprised between points 36a and 38a, after folding of gabled top portion 4 has been completed and panel A is superimposed onto panel C.

More specifically, angles θ and θ_1 can be calculated as follows:

$$\theta = 180° - \alpha - \beta,$$

taking into account that α is also the angle formed by each crease line 43, 45 with the respective portion of crease line 33 located outside flap zone 47 and starting from respective points 36a, 38a;

$$\theta_1 = \arccos\left(\frac{c / 2}{l_1}\right)$$

wherein l_1 references the length of crease lines 43, 45 and can be calculated as a function of length l and top angle α by the following formula:

$$l_1 = \frac{l}{\cos(90 - \alpha)}.$$

The formula for calculating θ_1 derives from the consideration that, after

folding of gabled top portion 4, crease line 45 defines the hypotenuse of a right-angled triangle, whose catheti are identified by a segment extending from the top vertex of side top wall 9 to a middle point of the portion of crease line 33 comprised between points 36a and 38a, and by the half of such portion of crease line 33 adjacent to the hypotenuse.

Angle β_2 allows construction of crease lines 57, 58, 59 and definition of their intersection point 61.

Knowledge of angles β_2, θ, θ_1 allows to calculate angle β_1 formed by crease lines 57, 58 with the portion of crease line 33 comprised between points 36a and 38a:

$$\beta_1 = \beta_2 + (\theta_1 - \theta).$$

Angles α and θ make it possible to design crease lines 43 and 45.

Intersection point between crease lines 52 and 66 can be determined by calculating angle γ formed by portion 67 of line 66 with the portion of crease line 31 comprised between crease lines 43 and 59.

In particular, angle γ is a function of angle θ_2, which is formed by crease line 45 with crease line 43 after folding of gabled top portion 4 has been completed and panel A is superimposed onto all the other panels.

Angle γ can be calculated as follows:

$$\gamma = \frac{\alpha - (\theta_2 - \alpha)}{2},$$

wherein angle θ_2 can be obtained through the formula

$$\theta_2 = 2 \text{ arcsen} \left(\frac{c/2}{l_1} \right).$$

Therefore, the following formula can be determined for calculating angle γ:

$$\gamma = \frac{\alpha - \left(2 \text{ arcsen} \left(\frac{c/2}{l_1}\right) - \alpha\right)}{2}.$$

Knowing angle γ, it is possible to design portion 67 of crease line 66 and obtaining the position of the intersection point between crease lines 52 and 66. Portion 68 of crease line 66 can be obtained by connecting the above intersection point with intermediate point 61.

Figure 8 shows another example of a gable top package referenced as a whole with number 1' and obtainable according to the above described method by varying the values of top angle α and length l of sloping top wall 10.

The advantages of package 1 and 1' according to the present invention will be clear from the foregoing description.

In particular, by simply putting the condition that the forming of the side top walls 18, 19 of the package 1, 1' is obtained by means of rotations of the panels A, B, C, D, E, F, G of sheet packaging material 2 as rigid bodies about their respective crease lines, it is possible to differentiate size and shape of gabled top portion 4 while ensuring a properly folding of the packaging material and a correct closure of the package.

Moreover, thanks to the fact that the folding of the different parts (panels A, B, C, D, E, F, G of packaging material 2) of packaging material 2 is obtained by means of rotations and therefore without relevant deformations and consequent stresses, the integrity of the aluminium layer, which is strongly less flexible than the other layers of the packaging material, is not compromised during the forming steps.

Clearly, changes may be made to packages 1, 1' as described and illustrated herein without, however, departing from the scope of the accompanying Claims.

In particular, it will be understood that main portion 3 of packages 1, 1' comprised between edges 21, 22 and crease lines 31, 32 may have any design shape.

Moreover, in each flap zone 46, 47, the portion 68 of crease line 65, 66 may

be defined at least in part by a pair of parallel lines having respective ends converging in a single line towards the relative intermediate point 60, 61. In this way, in the zone of portion 68 of crease lines 65, 66, the deformation of the packaging material due to the thickness of the panels superimposed is reduced.